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THE RUSSULAS OF NORTH CAROLINA*

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Plants solitary or gregarious, regular, rigid, but fragile from the structure of the flesh which in the cap is composed of large spherical cells, and not filaments, thus agreeing with *Laetarius*. Cap convex, plane, or depressed in center, exhibiting a great variety of colors, many of which are quite conspicuous, such as red, yellow, green, blue, pink, etc. Gills attached, rigid, but quite fragile. Stem central, rigid. Veil absent. Spores usually globose, white, creamy, or yellow.

The genus *Russula* is represented in North Carolina by numerous species which occur in large numbers through the summer. Many of these are conspicuous on account of their bright color and comparatively large size. The following notes have been prepared in the hope that they may be of assistance to those of the state who become interested in this attractive group. It will be understood that the work on this genus is far from being complete. A number of our species are not clearly defined, and there is much disagreement in regard to them in Europe. Our American species cannot be finally disposed of until some of this doubt is cleared away. It is hoped that the results of several years of work on this difficult genus may be of assistance to others, and help to bring about a better knowledge of the *Russulas* of our state.

In studying the *Russulas* it is of great importance to secure a good spore print. A mature cap should be placed on white paper over night,

*In our series of studies of the fleshy fungi of North Carolina, the treatment of this genus has been undertaken by Mr. H. C. Beardslee of Asheville, who has paid special attention to the *Russulas* for many years. All descriptions and remarks are by him except where otherwise indicated, the notes by me being selected by him from among those sent him. All numbers and all notes and remarks by me refer to our Chanel Hill collections. The origin of the photographs is indicated in each case.—W. C. COKER, Editor.

and, if the specimen is a good one, a mass of spores will be deposited whose color will be distinct. The colors of the spore masses are very constant so that the species can be divided into fairly sharply defined groups on the basis of their spore colors. In addition, some species will be found to be peppery or acrid in taste, while others are mild. Using these characters as the basis of division, I have made six groups which it is hoped the beginner will find definite enough to enable him to place his species with fair accuracy.

Group I includes the species in which the spores are pure white with no trace of cream color, and the taste is mild. Group II includes the white spored species whose taste is acrid. Group III includes the species whose spores show any trace of cream and are not darker than a distinct cream color (about maize yellow of Ridgway's key, or about the color of the spores of *R. flavida*, which is quickly recognized), and whose taste is mild. Group IV has the same spore color and the taste acrid. Groups V and VI include the species whose spores are darker than maize yellow, and are mild and acrid respectively. It is hoped that these will be found fairly easy of determination, though it is too much to hope that species will always be easy to identify.

Those who are fortunate enough to have the use of proper lenses will also find that, contrary to the usual belief, very valuable information can be obtained by a careful microscopic examination of the spores. For this purpose a good 1/12 in. oil immersion objective is required. With such an objective of good quality, it will be found that the spore markings separate the spores into three classes. One series of species have the spores nearly smooth. They seem, with a low power, to be entirely smooth; but, with higher powers, are seen to be marked with faint warts and lines. A second series have the surface set with more or less prominent spines. In this series the character of the spines is quite constant in each species, some having the spines fine and closely set, while others are coarse and scattering. A third series have the surface marked with raised lines which usually unite in a reticulation. While some information can be obtained from an objective of ordinary power, an objective of higher power and good quality will

be found to furnish very precise, determinative information. *Russula meliogens*, for example, appears in many disguises. Under a powerful magnification the large globose spores, which are nearly smooth, at once identify it.

In our literature these characters have been largely ignored. The spore of *R. foetans* is, for example, always spoken of as "coarsely tuberculate"; while the truth is, its spores are marked with distinct reticulating lines. These characters have been found so useful that a painstaking attempt has been made to accurately describe each spore as it appears when highly magnified.

The drawings of the spores of twenty-nine species of *Russula* which appear in plate 112 have been copied from drawings made during the past three years. In every case a large number of spores from different specimens have been examined and a characteristic drawing has been selected. I am entirely aware that the spore surface as it is here shown is not in accord with the usual description of several of the species represented. It is probable that in some cases I have not correctly represented the spore characters. To accurately fix the limits of variation, specimens from different locations must be examined in large numbers. This has not been done as yet. In some cases, also, there is disagreement in regard to species. In addition it may be said that accurate work is laborious and requires good conditions of light and appliances. Those who are interested to test the matter carefully will find that their oil immersions will give them valuable assistance in their work.

Mistakes have doubtless been made, but it is hoped that this contribution to the study of this very difficult genus will be found of value.

Important American Literature:

- Peck N. Y. State Cab. Rep. **23**:120. 1872.
Peck N. Y. State Mus. Bull. **116**:67. 1907.
McAdam. Jour. of Mycology **5**:58. 1889.
Beardslee. Mycologia **6**:88. 1914.
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Burlingham. North American Flora **9**:201. 1915

KEY TO THE SPECIES*

Spores pure white, like chalk; taste mild.....	Group I
Spores pure white, like chalk; taste acrid.....	Group II
Spores creamy white to cream color; taste mild.....	Group III
Spores creamy white to cream; taste acrid.....	Group IV
Spores deep cream to ochraceous; taste mild.....	Group V
Spores deep cream to ochraceous; taste acrid.....	Group VI

GROUP I. SPORES PURE WHITE; TASTE MILD

Cap persistently white	<i>R. delicata</i> (1)
Cap some shade of red.....	1
Cap green or purple.....	<i>R. variata</i> (2)
Cap not as above.....	2
1. Stem white or reddish.....	<i>R. uncialis</i> (3)
1. Stem deep red.....	<i>R. purpurina</i> (4)
2. Flesh becoming black when wounded, and in dry- ing	<i>R. adusta</i> (5)
2. Flesh becoming red, then black when wounded...	3
2. Not as above.....	4
3. Gills thin crowded.....	<i>R. densifolia</i> (10)
3. Gills thicker, subdistant to distant.....	<i>R. nigricans</i> (11)
4. Color dull bay.....	<i>R. compacta</i> (6)
4. Color yellowish-straw translucent.....	<i>R. Earlei</i> (8)
4. Color yellow or cream, not translucent.....	<i>R. flava</i> (16)
4. Cap pale, with numerous small, appressed scales...	<i>R. floccosa</i> (9)

GROUP II. SPORES PURE WHITE; TASTE ACRID

Cap some shade of red.....	1
Cap at first white or whitish.....	2
Cap some shade of green or purple.....	<i>R. variata</i> (2)
Cap yellowish	<i>R. ochroleuca</i> (12)
Cap yellowish straw color, tough, translucent.....	<i>R. Earlei</i> (8)
1. Gills rather distant, nearly free.....	<i>R. emetica</i> (13)
1. Gills close, adnexed.....	<i>R. fragilis</i> (14)
2. Flesh becoming black when wounded.....	<i>R. adusta</i> (5)
2. Flesh becoming rusty-ochraceous when wounded..	<i>R. compacta</i> (6)
2. Flesh becoming brick-red when wounded.....	<i>R. magnifica</i> (7)

*Figures in parenthesis refer to the species number. In addition to some of the species described here, Curtis also lists from Schweinitz *R. lactea* Fr., *R. substipitata* Fr., *R. nitida* Fr., and *R. ochracea* Fr. The plants so determined are probably included by us under other names. His *R. depallens* and *R. lutca* Fr., we have entered with a question under *R. decolorans* and *R. flava*.—COKER.

GROUP III. SPORES CREAMY WHITE TO CREAM; TASTE MILD

- Stem becoming red, then black, when wounded.....*R. cinerascens* (15)
 Not as above.....1
 1. Cap white or nearly so, taste slightly bitterish....*R. albida* (16)
 1. Cap yellow or cream color, taste quite mild.....2
 1. Cap some shade of red.....3
 1. Cap purplish or vinaceous.....5
 1. Not as above.....6
 2. Stem white*R. flava* (17)
 2. Stem yellow*R. flavida* (18)
 3. Stem becoming cinereous with age.....*R. decolorans* (19)
 3. Not as above.....4
 4. Small, cap 2-4 (rarely 5) cm. broad.....*R. pusilla* (20)
 4. Larger, strong odor of new meal in drying.....*R. meliolenis* (21)
 5. Cap distinctly pruinose*R. Mariae* (22)
 5. Cap not distinctly pruinose.....*R. cyanoxantha* (23)
 6. Cap greenish, with appressed scales, margin nearly
 even*R. virescens* (24)
 6. Cap with margin distinctly striate.....*R. crustosa* (25)

GROUP IV. SPORES CREAMY WHITE TO CREAM; TASTE ACRID

- Cap white*R. albidula* (26)
 Cap red1
 Cap not as above.....2
 1. Taste very acrid.....*R. sanguinea* (27)
 1. Taste slightly acrid.....*R. lepida* (28)
 2. Cap large, sordid-yellowish or ochraceous.....*R. fatans* (29)
 2. Smaller, cap brown or gray.....*R. pectinata* (30)
 2. Smaller, cap conspicuously granular.....*R. pulverulenta* (31)

GROUP V. SPORES DEEP CREAM TO OCHRACEOUS; TASTE MILD

- Stem becoming red, then black, when wounded.....1
 Stem becoming yellow when wounded.....2
 Stem white, yellow or orange at the base.....*R. luteobasis* (32)
 Not as above.....3
 1. Cap red*R. rubescens* (33)
 1. Cap cream color*R. magna* (34)
 2. Odor in drying strong and disagreeable.....*R. xerampelina* (35)
 2. Not as above.....*R. puellaris* (36)
 3. Cap dingy white, straw color or greenish; spores
 light yellow4
 3. Cap some shade of red or purple.....5
 3. Cap with distinct shades of golden yellow.....*R. aurata* (37)

4. Cap dingy white, or shaded with yellow or reddish yellow *R. basifureata* (38)
4. Cap dingy straw color *R. grisea* (39)
4. Cap olivaceous green *R. olivascens* (40)
4. Cap grass green *R. graminicolor* (41)
5. Cap distinctly velvety *R. subvelutina* (42)
5. Cap purple to purple-brown; odor with age disagreeable *R. nauseosa* (43)
5. Cap red or purple-red, spores deep ochraceous.....6
6. Spores reticulated *R. Romellii* (44)
6. Spores spinulose *R. alutacea* (45)

GROUP VI. SPORES DEEP CREAM TO OCHRACEOUS; TASTE ACRID

- Cap orange, fading to orange or yellow..... *R. aurantialutea* (46)
- Cap not as above.....1
1. Stem becoming red when wounded..... *R. tenuiceps* (46)
1. Stem not becoming red when wounded..... *R. pungens* (47)

1. *Russulæ delica* Fr.

PLATES 70 AND 111.

Cap firm, white, 7.5-12.5 cm. broad, soon depressed and infundibuliform, dull and opaque in appearance, more or less marked with rusty spots.

Gills rather crowded, white or slightly rusty, often forking. with some shorter, adnate, decurrent; taste mild, or slightly acrid.

Stem short, firm, colored like the cap.

Spores subglobose, 7-9 μ long, spinulose.

In woods, not rare, Asheville.

Asheville specimens of this species seem to vary. I find occasional specimens which could possibly be referred to *R. chloroides* as Bresadola describes it. I am unable to satisfy myself, however, that we have more than one species.

Notes by Coker follow:

This is a peculiar plant, often imperfect and aborted, that is not rare in lawns and groves. Cap rarely expanded, usually failing to get entirely out of the ground, nearly always extremely irregular, roughly hemispheric until nearly grown, then expanding and cracking and rough; very often the margin of the cap remaining attached to the ground, and the cap splitting into three or four pieces which break

from the short stem and form a disordered mass; surface white or sordid white, tomentose to smoothish, and much obscured by earth particles, the margin hardly more than minutely velvety. Flesh white, about 4-8 mm. thick near stem, firm and hard, not changing, or brownish in old wounds, a very disagreeable fishy taste at first, then sharply peppery.

Gills light sea-green when young, becoming nearly pure white at maturity, sordid-ochraceous on old wounds, adnexed, moderately close, none forked, veined at stem and often with cross partitions, sometimes dedaloid near the margin, 3-5 mm. wide, secreting clear drops when young.

Stem short, about 3 cm. long, and 1.9-2.8 cm. thick, glabrous, rugulose, firm and usually solid, sometimes cavernous, the base not coming free, but diffused into the earth with the mycelium.

Spores (of No. 2188) pure white, subspherical, spinulose, 7-9 x 9-10.5 μ .

These plants are suspiciously like a *Lactarius*, though without milk. It is described by others as having a mild or only slightly acid taste. It may be that ours is *R. chloroides* Bresadola. In all our plants the gills are distinctly sea-green when young.

2188. Under oaks in Mrs. Kluttz' lawn, June 21, 1916. Photo.

2211. In Dr. Wheeler's lawn, June 23, 1916.

2216. Under oaks, lawn of "The Rocks," June 24, 1916.

2544. In path in mixed pine and oak woods back of athletic field, June 22, 1917.

The illustration in *Mycologia* 8:No. 3, Pl. 183, fig. 1, is of a form much darker than our plants.

2. *Russula variata* Banning.

PLATES 72 AND 111.

Cap 6-10 cm. broad, firm, convex, soon becoming depressed and infundibuliform, colored with a peculiar mixture of olive green, purple and gray, usually darker and more olive at the center, and lighter and more purple at the margin; surface dull and opaque, usually marked with delicate wrinkles which form a reticulate network. Margin thin, even or nearly so; flesh firm, becoming thin at the margin; taste slowly acid.

Gills crowded, white, much forked, at first very narrow, becoming broader with maturity, decurrent.

Stem white, firm, cylindrical, pruinose at top.

Spores pure white, delicately warted, subglobose, 6-6.5 x 7-8 μ long.

This species is very abundant in our woods; possibly it is our most abundant species. The peculiar combination of its colors and its narrow, forking lamellæ distinguish it. It is, however, a problematic species, in my opinion. It has been closely observed at Asheville, and it seems clear that we have only this species in the group. I find old specimens which have lost their acidity, and have lost also most of their purple color. In these plants the lamellæ are broader, and they might well be referred to a different species. They are, however, certainly only an older form of the same plant. *Russula furcata*, to which this species is related, seems to be also problematic. Romell, whose thorough knowledge of the Swedish Russulas is well known, writes me that he has never seen it in Sweden. Maire says it is much misunderstood in Europe. Peck says he has found it in one limited locality. I have seen nothing that can be referred to it at Asheville. It seems best to use for our plant Banning's name, though it seems probable that when the European species are satisfactorily defined we shall find that our plant is not unknown in Europe.

Notes by Coker follow:

Color very variable and with peculiar shades, usually dull olivaceous with tint of purple in center, shading to light pallid purplish towards margin, varying from this to pale purplish or purplish green or greenish; sometimes with rather distinct zonations of color. Flesh quite mild or moderately acid, varying in this respect at all ages, usually grayish in age.

Gills much forked or almost none forked, very variable in this respect, and also in color when bruised, which may become scorched or may not change. A very common plant in woods and groves.

1569. Battle's Park, June 21, 1915.

2077. Shaded lawns of the old Mangum Place, June 12, 1916. Spores chalk white, minutely tuberculate, 5.5-7.4 μ .

2099. Dr. Lawson's lawn, June 14, 1916. Spores chalk white, spherical, minutely tuberculate, 5.9-7.4 μ .
 2137. Grove by Gimghoul Lodge, June 18, 1916.
 2172. Battle's Grove, June 20, 1916.
 2217. Lawn of "The Rocks," June 24, 1916.
 2262. Oak woods at top of Lone Pine Hill, June 27, 1916.

Middle district (Schw. as *R. furcata?*), woods and thickets. Curtis.

3. *Russula uncialis* Pk.

PLATE 111.

Cap 1.3-7.5 cm. broad, soon becoming plane, viscid when moist, red or pinkish red, minutely granulose, striate on the margin; flesh thin, white; taste mild.

Gills white, narrowed toward the stem, moderately close, usually red on the margin on the outer third.

Stem white or colored like the cap, but lighter; pruinose at the top, stuffed or spongy within.

Spores pure white, broadly ellipsoid, 7-9 μ long, marked with more or less elongated warts.

In lawns under trees, common, Asheville.

The color of this attractive species is different in quality from that of *R. fragilis*. It is distinctly a pink red. It occurs with us in lawns and along paths in the woods. I find it quite variable and often exceeding the dimensions given by Peck. One form which occurs in lawns seems almost distinct. It has a longer stem than is typical, which is distinctly red. The mild taste, delicately pruinose cap, and pure white spores easily distinguish it.

Notes by Coker follow:

Cap 3.5-6.5 cm. broad, depressed in center, margin distinctly striate, surface pruinose, granulose, sometimes almost pubescent in center, and in some cases (No. 1667) strongly tuberculate in center; color a dull rosy red, almost Corinthian red of Ridgeway, somewhat darkest in center; cuticle easily removable, viscid when moist; flesh white, soft, thin, not very fragile, tasteless.

Gills adnexed, all of equal length, about 4 mm. wide at the wide marginal end; white, then pallid cream, interveined.

Stem 3.5-5 cm. long, about 7-13 mm. thick at top, enlarged or somewhat smaller below, smooth, usually white below, rosy elsewhere but not with granules, stuffed or cavernous inside.

Spores (of No. 1667) pure white, subspherical, moderately tuberculate, 6-7.2 μ . Gill margin set with numerous, abruptly apiculate cystidia.

1667. In low woods near Howell's branch, July 28, 1915.

2315. Battle's Grove (oaks), June 30, 1916. Spores about 7 x 8 μ .

2517. Dry oak woods east of cemetery, June 14, 1917. Gills interveined; spores subspherical to oval, warted, pure white, 6.6-7.4 x 7.4-8.2 μ .

4. *Russula purpurina* Q. & S.

Cap deep red, 5-10 cm. broad, convex then plane, at first even on the margin, then somewhat striate, cuticle separable, fragile, flesh white, reddish under the cuticle; taste mild.

Gills thin, moderately close, white, becoming slightly yellowish, usually pink and floeculose on the margins.

Stem colored like the cap, but often lighter, spongy within, nearly equal.

Spores broadly ellipsoid, 7-9 μ , marked with elongated warts.

In woods, rare, Asheville.

This is a larger and more deeply colored plant than *R. uncialis*. It has been detected only a few times at Asheville, and has not been thoroughly studied. It seems, however, the same plant that has been reported farther north.

5. *Russula adusta* (Pers.) Fr.

PLATES 73 AND 111.

Cap 7.5-15 cm. broad, white, becoming sooty-gray, and then blackish with age and in drying; flesh firm, white, becoming black when wounded; margin even, thin. The gills have an aerid taste, otherwise the flesh is mild.

Gills thin, crowded, adnate, nearly equal, blackening when wounded.

Stem solid, firm, white, blackening when wounded.

Spores subglobose, 7-9 μ , warted.

This is usually referred to *R. sordida* Pk. It is, however, the same plant which we collected in Sweden with Romell as *R. adusta*. Maire states that the flesh of *R. adusta* becomes black at once when it is broken, and Romell, whose thorough knowledge of the Swedish Russulas is well known, so understands it. Carleton Rea, the eminent English authority, states in a letter that "*R. adusta* is characterized by its narrow, moderately crowded lamellæ, and its white flesh which turns to black when broken." His figures, which I have examined and discussed with him, agree with our plant. I have preferred to follow these authorities in spite of the difficulties of the description.

Asheville. Beardslee.

Middle district (Schw.), woods and thickets. Curtis.

5a. *Russula adusta* (Pers.) Fr. Form with unchanging flesh.

Coker's description of a Chapel Hill form with unchanging flesh is as follows:

Very large and stout plants of dull color. Cap up to 14 cm. broad, not zoned, depressed in center, lightly roughened and wrinkled with areolations and frequently with cracks. Color a smoky tan to snuff-brown. Flesh grayish-white, soft and fragile, about 8-9 mm. thick half way to margin, not becoming black when wounded.

Gills nearly white when young, passing through a creamy flesh color to a much deeper flesh-tan with a touch of lavender, distant, none forked, many very short ones at margin, very fragile, squarely attached or slightly rounded at the stem, about 1 cm. wide at the deepest point, which is beyond center.

Stem very large, tapering downward, about 6-7 cm. long and 3-3.7 cm. thick. Flesh like that of the cap, solid, but soft and fragile; surface smooth, about color of cap except the nearly white base.

Spores white, spherical, roughened, with one large oil drop; 7.4 μ in diameter.

It is probable that the change of flesh color in *R. adusta* when wounded may not be a constant character and that this is really the same as the above.

1146. Sphagnum moss bed east of athletic field, July 18, 1914.

6. *Russula compacta* Frost.

PLATE 74.

Cap 7-15 cm. broad, at first convex, with the margin incurved, at length expanded and depressed at the center, at first white or whitish, becoming pale tawny, dry and opaque, the cuticle with a texture like kid. Flesh white, firm, becoming brown when cut, about 10 mm. thick near the stem, thinner towards the margin; taste in my specimens mild, odor very faint, but becoming disagreeable in drying.

Gills rather close, narrow, about 8 mm. broad at the broadest point, much narrower toward the stem, creamy white, becoming brown when injured and in drying, adnate.

Stem spongy stuffed, white at first, changing color like the gills, 2-3 cm. thick, 4-7 cm. long.

Spores white, globose, $7-9\mu$ broad, appearing nearly smooth under a $1/5$ objective, with higher magnification clearly warted.

This species has been found only twice at Asheville. My specimens were entirely mild in taste, though it is said to be at times slightly acid. The peculiar brown color of the gills and to a less extent of the cap and stem in drying is characteristic. It will probably be found throughout the state.

Notes by Coker follow:

Low, stout, heavy plants, gregarious or caespitose in low mossy woods. Cap up to 11 cm. broad, not zoned, depressed in center, the margin strongly bent down, and remaining so until late, fully expanded only at full maturity. Surface smooth and dull bay color all over except for lighter areas where covered over with leaves or trash; texture of leather and often cracked near the margin. Flesh white, firm, turning light brown when cut, about 4-6 mm. thick half way to margin; taste mild. The plant is said to develop a somewhat disagreeable odor on drying, though it has no distinctive smell when fresh.

Gills crowded, narrow, broadest near margin, where they reach 2.5-5 mm., squarely attached to stem, white or pallid, turning a deep scorched brown when bruised and deepening to this color in age.

Stem short and stout, solid, but often badly riddled by grubs, 3-4

cm. long and 1.5-2 cm. thick; surface pruinose, smooth, pure white except that the base is usually discolored by contacts to the shade of the cap.

Spores white, spherical, rough, a large oil drop, varying considerably in size in the same plant, 6.8-9.2 μ , mostly about 7.5 μ in diameter.

This species is new to the south, being reported by Miss Burlingham only from New England, New York, and New Jersey.

1134. Low woods at foot of Lone Pine Hill, July 13, 1914. Photo. Spores 7-9.2 μ in diameter.

1163. In hollow below sphagnum moss bed east of athletic field, July 20, 1914. Spores 6.6-8 μ in diameter.

2316. Damp woods at foot of Lone Pine Hill, June 28, 1916.

2319. Mossy soil, Battle's Grove (oaks), June 30, 1916. Photo.

2557. Battle's Grove (oak), June 22, 1917.

Beaufort, abundant. Beardslee.

7. *Russula magnifica* Pk.

This has been found only in Chapel Hill and the following is by Coker:

Cap up to 13 cm. broad, rounded and umbilicate when young, deeply infundibuliform in age, smooth, not shining, pure white when quite young and untouched, but soon with shades of fleshy-buff, or brick and deeper buff when older; surface when young scurfy-coated, the scurf soon cracking up, easily rubbed off, and thus disappearing entirely at times. Beneath the scurf is a very distinct surface layer that can be easily peeled off. Flesh dry, firm, brittle, mild, but with a peculiar, rather disagreeable, flat earthy taste, from 0.9-1.3 cm. thick in center, turning quickly a clear brick red on the surface and next the gills when bruised, after maturity more slowly changing.

Gills crowded, many short ones of various lengths, unbranched, squarely attached in youth, apparently decurrent later from the shape of the cap, light fleshy-cream when young, deep brick red when old and on drying, turning reddish when bruised, 3.5-6 mm. deep in center.

Stem short or moderately long, 3.5-9 cm. long, tapering or almost equal, about 2 cm. thick in center, smooth, dull, stained usually like the cap below, white above, becoming colored all over in age, solid

but soon riddled by grubs; flesh turning pink near the surface after a time when cut.

Spores (of No. 873) white, spherical to elliptic, minutely roughened, $5.5-7 \times 5.5-11\mu$.

A large plant with the general appearance of *Lactarius piperatus* but without milk. It is not rare in mixed woods from late June to October. The occurrence of this fine species here is interesting as it has been known before only from the type locality at Port Jefferson, New York. There can be no doubt that our plant is this species, as it agrees in all important respects with the type and the spores are identical (compared by Beardslee).

Illustrations: Bull. N. Y. St. Mu. 67, Pl. N.

873. Battle's Park, in dry woods behind Dr. Wheeler's, scattered and solitary, October 3, 1913. Photo.
 901. Battle's Park, north of the cemetery, October 7, 1913.
 2326. By Meeting of the Waters branch, damp soil, June, 1916. Spores white, spherical to elliptic, minutely roughened, $5-7 \times 6-10\mu$.
 2375. Mixed upland woods near Piney Prospect, July 8, 1916.

S. *Russula Earlei* Pk.

PLATE 75.

This has been found only in Chapel Hill, and the following is by Coker:

Cap up to 7 cm. in diameter, a light yellowish straw color, with a translucent watery appearance, depressed in center with margin rounded and not at all striate, edge of young plants inrolled; surface viscid, smooth except for small blisters in places, the embedded eggs of an insect. Flesh white, unchanging, pithy, about 1 cm. thick, mild (as in No. 2765) or slowly and moderately peppery (No. 2292), toughish and firm, not easily breaking, but formed of vesicular cells.

Gills watery white, becoming light creamy flesh color, distant, thick, many short ones and a few forked, about 3-9 mm. wide in center, narrowing at both ends, turning sordid when bruised. Basidia four-spored, sterigmata about 5μ long.

Stem up to 5 cm. long and 2 cm. in diameter, tapering towards the base, white, solid, but somewhat pithy, turning dark only in a line along the surface of the ground.

Spores pure white, short elliptic, minutely tuberculate, $3.7 \times 4.4-5.5\mu$.

Remarkable for the watery, translucent appearance when fresh. Except for the absence of milk this plant looks much more like a *Lactarius* than a *Russula*. The gills undergo a change of color in drying just as in many species of *Lactarius*, and the general appearance is that of a *Lactarius*. However, in respect to tradition and for convenience I refer this to *R. Earlei* with which it seems to agree well except that there is no mention in the description of that species of a peppery taste at times, a somewhat variable quality in *Russula*. The species is easily separated from others by the distant gills, small spores and tough flesh. It has been reported heretofore only from Long Island.

2292. Damp shaded woods by Howell's branch, north of Dr. Henderson's, June 28, 1916. Photo.

2337. Deciduous woods by path along Battle's branch, just east of Dr. Battle's, July 1, 1916.

2765. Low woods near ditch north of cemetery, July 24, 1917. Taste mild; gills about 9 mm. wide in older plants.

9. *Russula floccosa* Buri.

PLATE 111.

Cap rather thin, pale, sprinkled with adnate granules which have a vinaceous color, becoming striate on the margin.

Gills thin, crowded, equal white.

Stem colored like the pileus, stuffed then hollow, glabrous.

Spores white or creamy white, almost globose, 6.5 to 7.5, nearly smooth.

Only one specimen of this species was found. The cap is almost creamy white in this, but the numerous vinaceous granules give it a purplish color. It seems quite distinct. My spore print was not decisive. The color seemed white, but whether with a tint of cream could not be ascertained.

10. *Russula densifolia* Seer.

Cap 5-10 cm. broad, convex then depressed, at first white or nearly so, becoming gray or smoky brown with age; flesh firm, white, becoming red then black when broken.

Gills thin, rather crowded, adnate or decurrent, white changing like the cap.

Stem firm, solid.

Spores pure white, subglobose 7-8 μ , nearly smooth.

This species has the lamellae of *R. adusta*, but its flesh changes to red then black as does that of *R. nigricans*. Bresadola considers it merely a form of *R. adusta*, which may well be true. It is rather common in the western part of the State.

Notes by Coker follow:

1155. Swamp of New Hope Creek, near Durham bridge, July 18, 1914. Spores white, spherical, minutely tuberculate and brokenly reticulated, 7-9 μ .

11. *Russula nigricans* (Bull.) Fr.

PLATES 76 AND 111.

Cap 7-17 cm. broad, dingy-white when young, becoming gray with age and smoky-brown or black in drying, slightly viscid, firm and fleshy, convex then depressed at the center. Flesh thick and solid, white, becoming red then black when wounded, taste mild.

Gills thick, white, distant, alternating long and short, in robust specimens almost 2 cm. broad at the center, rounded behind, becoming black with age and in drying.

Stem firm, solid, white, 3-4 cm. long, 2-3 cm. thick, changing like the flesh of the cap.

Spores pure white, nearly smooth, broadly ellipsoid, 7-8 μ long.

This is not rare in our Asheville woods. The broad distant gills and the quick change of the flesh to red and then black when wounded easily distinguish it. It is recommended as an edible species, but its appearance is unattractive.

Notes by Coker follow:

This species is common in Chapel Hill, and appears as described above except that the flesh is often smoky-gray when first exposed, then turning red and finally black when bruised. The odor of young plants is hardly noticeable, but old ones have a rather distinct odor of old ham. Spores pure white, spherical to oval, slightly roughened, 7.4 x 7.4-9.2 μ .

1151. Open grove west of campus, July 16, 1914.
 1152. On bank by road, just east of athletic field, July 16, 1914.
 1206. By Battle's branch, just east of Dr. Battle's house, July 24, 1914.
 1378. In woods with cedars, northwest of Glenn Burnie barn, October 18, 1914. Spores 5.9-6.8 x 6.8-8.5 μ .
 1819. Pine woods at top of Lone Pine Hill, September 16, 1915.
 1955. Under *Pinus inops* on hillside just north of King's millpond, October 31, 1915.
 2074. Shaded lawn of the old Mangum Place, June 12, 1916. Taste moderately peppery; cap viscid; flesh turning red, then blackish.
- Balsam, North Carolina (Jackson County), mountains (our No. 1640), July 23, 1915. Miss Totten.

12. *Russula ochroleuca* Fr.

Schweinitz reports this species from North Carolina, but no others have recognized it here, and the only American station given by Miss Burlingham is in Alabama. Her description is as follows (*N. Am. Flora* 9:218. 1915):

"Pileus fleshy, becoming plane or depressed, 5-7 cm. broad; surface luteous, fading, with a thin, closely adnate pellicle, polished; margin even, remotely striate when old; context acrid; lamellæ white, then pallid, nearly equal, rounded behind, free, broad; stripe white to cinereous, firm, spongy within, reticulate-rugose, 2-3 cm. long; spores white, ovate, papillate, 7 μ in diameter. In moist places in woods."

Middle district (Schw.), woody hillsides. Curtis.

13. *Russula emetica* Fr.

PLATE 97.

Cap 5-10 cm. broad, bright rosy red to blood red, varying to white, viscid, margin at length tubercular striate. Flesh white, red under the separable cuticle; taste sharply acrid.

Gills white, nearly free, rather distant.

Stem stuffed then becoming hollow and fragile, white or reddish.

Spores pure white.

A handsome species with intensely acrid taste. It is close to the following species from which it will not be found easy to distinguish it. As I find it, it is rather larger and the gills are different, as described. Asheville.

Notes by Coker follow:

Colored illustrations: Gibson. Our Edible Toadstools and Mushroom. Plate 13. Taylor, Food Products, II, Plate 2.

1671. In wet soil at edge of Meeting of the Waters branch, July 28, 1915.
Flesh white all through, not red under the pellicle, otherwise exactly like *R. emetica*. Spores white, spherical, with very short echinulations, 6-8 μ .

Blowing Rock. Atkinson.

Common in woods. Curtis.

14. *Russula fragilis* Fr.

R. subfragilis Burl.

Cap 2.5-5 cm. broad, bright red to pale red. flesh color or even white, thin, soon becoming plane or depressed, viscid when moist, margin thin, tuberculate striate; flesh very thin, white; taste sharply acid.

Gills adnexed, thin, crowded, equal, white.

Stem soon hollow and fragile, white.

Spores white, subglobose, 7-8 μ long, echinulate.

In woods and open places, common.

This species is found throughout the growing season and is easily separated from all its relatives except *R. emetica*.

Middle district (Schw.), in woods. Curtis.

15. *Russula cinerascens* n. sp.

PLATES 78 AND 111.

Cap 8-12 cm. broad, convex, then depressed at the center, viscid when moist, dull flesh-red, to cinnamon buff, fading to sordid gray with olive and vinaceous tints at maturity, at length striate on the margin, cuticle separable on the outer third. Flesh white, becoming cinerous with age; taste mild.

Gills rather close, white, then pale cream, forking 10 mm. broad at the center, attenuate toward the stem, a little rounded behind.

Stem white, spongy within, nearly equal, quickly becoming red, then black when wounded; in mature plants entirely cinerous within.

Spores pale maize yellow, nearly globose, nearly smooth $7-9\mu$.

This is one of our most interesting species. The color is quite variable. In the numerous collections found this year the plants in woods are quite uniformly more or less red or dull vinaceous. In plants found in open places the red is almost entirely lacking and the plants are then almost Ridgway's cinnamon buff. As they reach maturity, the flesh of the entire plant becomes cinereous and the color of the cap becomes sordid gray with tints of olive and vinaceous.

The species seems to suggest *R. depallens* Fr., but a careful attempt to connect the two has not been successful. Several European specialists to whom our plant has been submitted are positive in their belief that it is unknown in Europe, and that it is not *R. depallens*. Only three red Russulas seem to have the curious change of flesh noted in this plant. The difference in the spore characters of this species and *R. decolorans*, to which it seems related, is very marked. In specimens of *R. decolorans* from North Carolina and Sweden the spores are elliptic, $9-11\mu$, and coarsely tuberculate. Under a good oil immersion objective their contrast to the smaller, nearly globose, and nearly smooth spores of this species is very striking.

16. *Russula albida* Pk.

PLATES 79, 80, AND 111.

Cap 2-5.5 cm. broad, creamy white with the center often a deeper cream or yellowish, viscid when moist, cuticle separable halfway to the center, margin becoming slightly striate with age; taste mild then bitterish.

Gills white or creamy white, nearly equal, adnate and slightly decurrent.

Stem pure white, usually tapering upward, stuffed then hollow, 2-7 cm. long, 8-12 mm. thick.

Spores creamy white, ellipsoid to subglobose $7-9\mu$ long spinulose.

Forms of this species found growing along woodland roads have always an elongated, slender stem. Forms in lawns are always much shorter with the stem 2-4 cm. long. The species is common in woods and in lawns under trees at Asheville.

Notes by Coker follow:

We have found this in Chapel Hill, but the description below is of a fresh plant that was collected in the mountains and sent to us, arriving in fine condition (No. 1641).

Cap 10.5 em. wide, depressed in center, smooth, the margin faintly striate, surface smooth, slightly viscid, light cream on margin, yellowish in center. Flesh pure white, firm and very brittle, about 6 mm. thick near stem, mild at first, faintly bitterish after some time.

Gills all of the same length, attached but slightly rounded at stem, not at all decurrent, 6 mm. deep, nearly pure white, brownish when bruised.

Stem 5 em. long, 2 em. thick, equal, pure white or with brownish stains at base, quite smooth, very firm.

Spores (of No. 1641) light cinnamon buff, nearly maize yellow of Ridgway, subspherical to ovate, distinctly echinulate, 5.5-6.2 x 6.2-7.7 μ .

This plant agrees well with *R. albida* except in size, which is twice as large as the maximum allowed by Beardslee (above) or Miss Burlingham.

2573. In mixed pine and oak woods, Battle's Park, July 2, 1917.

2606. Mixed upland woods just above Theater, Battle's Park, July 7, 1917. Taste mildly bitterish when brought in (just mature), the next day still fresh under a damp chamber) distinctly though slowly acid.

Balsam (Jackson County), in mountains, July 23, 1915 (Miss Totten); our No. 1641. Photo.

Blowing Rock. Atkinson.

Hartsville, No. 27, near base of a pine, flat woods back of Hartsville plantation, June 29, 1917. Taste mild. Photo.

17. *Russula flava* Romell.

PLATE 81.

Cap 4-8 em. broad, convex, becoming nearly plane, yellow, slightly darker at the center, margin even at first, becoming slightly striate with age, viscid when moist.

Gills white, then cream color, becoming darker in drying, thick, rather narrow, adnexed.

Stem white, equal, becoming cinereous with age.

Spores cream color 7-8 μ long, broadly ellipsoid, spinulose.

One collection made July 19, 1916, at Asheville, is referred here, though with some doubt. It seems the same as the plant collected in Sweden and called *R. constans* by Romell, and later changed to *R. flava*. It is certainly rare in our State.

Notes by Coker follow:

Cap 4 cm. broad, convex, smooth (minutely granular under a lens), viscid when damp, creamy white or light yellowish all over, the margin not striate. Flesh pure white at first, but when cut turning light cinereous after some time, firm, not very brittle, about 5 mm. thick at stem, mild and odorless.

Gills rather close, none short, some branched near the stem, sinuate and narrowly adnexed, broadest and about 4 mm. wide near the outer end, veined at cap, the margins minutely denticulate, pure white at first, then faintly creamy in age, when bruised turning ochraceous or smoky after a long time.

Stem 3.1 cm. long, 1 cm. thick, nearly equal, puberulent, white or faintly creamy, and in age becoming tinted with cinereous, particularly below, solid.

Spores nearly pure white (faintly creamy), ovate-elliptic with a large eccentric mucro, minutely spinulose-warted, 4.8-5.5 x 5.5-7.4 μ .

This firm and attractive species is easily separable from *R. albida* by the lighter spores with smaller spines and by the absence of a bitterish taste; and from *R. albidula* by the yellowish tint, light spores, and mild taste. Our plant is only lightly tinted with yellow, giving the effect of cream over white.

2532. By path in mixed pine and oak woods back of athletic field, June 20, 1917. Photo.

18. *Russula flava* Frost.

PLATES 82 AND 111.

Cap 5-10 cm. broad, firm, convex, then expanded, and plane or somewhat depressed at center, chrome yellow, sometimes darker at center, dry and minutely pruinose, margin even. Flesh thin, white, taste mild.

Gills at first pure white, cream color or slightly dingy with age, not crowded, adnate.

Stem firm, becoming spongy within, colored like the cap or a little paler.

Spores cream color, subglobose, 6-8 μ , delicately reticulate.

Common throughout the summer at Asheville. This is one of the easiest of our species to distinguish. The clear chrome yellow of the cap and stem, and the pure white gills of the young plant mark it at once.

Notes by Coker follow:

Cap up to 7 cm. broad, strong yellow in center, lighter yellow on the margin, dull and smooth, margin not striate except a little when old, convex, slightly depressed in center, dry; taste mild.

Gills not crowded, broad and rounded at outer end, pointed at stem, about 5-6 mm. wide, whitish then pallid yellow, scarcely any short ones, veined at the cap.

Stem 5-6 cm. long, about 1.5-2 cm. thick, yellow all over or whitish at very top, and at times orange at base, smooth, stuffed but often quickly hollowed by grubs.

Spores creamy yellow, roughened, tuberculate, nearly spherical, 6.3 x 7 μ , not counting the distinct umbo.

122. Ravine back of Tenny's, October 2, 1909.
 465. Woods near Battle's branch, back of Dr. Wilson's, September 30, 1912.
 494. Battle's Park, near branch, October 4, 1912. Photo. Spores creamy yellow, subspherical, tuberculated and imperfectly reticulated, 7 x 8.3 μ .
 786. Path to Meeting of the Waters, near the brook, September 13, 1913.
 Spores creamy yellow, spherical, minutely tuberculate, 5.5-6.5 μ .
 810. In woods east of Graded School house, September 22, 1913.
 1390. Battle's Park, near east gate of campus, October 20, 1914.
 1582. Swamp of New Hope Creek, below Durham bridge, June 26, 1915.
 2092. Dr. Lawson's lawn, June 14, 1916.
 2566. Mixed woods, Battle's Park, July 2, 1917.

Middle district (Schw.), in woods (as *R. lutea*?). Curtis.

19. *Russula decolorans* Fr.

PLATES 83 AND 111.

Cap 5-10 cm. broad, orange yellow, becoming pale yellow and then pallid, convex then expanded and depressed, viscid when moist, striate and tubercular on the margin when mature. Flesh white, taste mild.

Gills thin, close, white then yellowish, adnexed, often in pairs.

Stem 5-10 cm. long, cylindrical, solid but spongy within, white, becoming cinereous especially within with age.

Spores pale yellow, broadly ellipsoid, 8-10 μ , spinulose.

Rare in the western part of the state, probably more common in the eastern portions. The cinereous discoloration of the flesh of the stem and cap with its color will distinguish it.

On the upper slopes of Mount Mitchell. Fine specimens in some abundance. Not found as yet at lower levels at Asheville.

Notes by Coker follow:

This species is much like *R. flavida* in color, but is usually more orange, and may otherwise be distinguished by the longer, white stem and very different spores.

573. Near Howell's branch, October 17, 1912. Stem almost pure white, longer than in *R. flavida*. Spores creamy yellow, distinctly sharp-spinulose (not reticulated), subspherical, 7.5-8 x 8.5 μ .

Middle district (Schw.), in pine woods (as *R. depallens?*). Curtis.

20. *Russula pusilla* Pk.

PLATES 84 AND 111.

Cap 1-3.5 cm. broad, convex, soon expanded and depressed at the center, bright red, or dull carmine, sometimes fading to almost buff, glabrous, viscid when moist, margin becoming slightly striate, cuticle separable nearly to the center. Flesh red under the cuticle, otherwise white; taste mild.

Gills white, then pale yellow, not crowded, equal, slightly rounded behind.

Stem pure white, rather slender, soon hollow within.

Spores maize yellow, 7-9 μ long, broadly ellipsoid, marked with spines and ridges.

Growing in lawns under oaks and along roads in woods.

Specimens found at Asheville seem to agree with a specimen from New York. They are larger than the limits of size in the original description, but not exceeding the size as Miss Burlingham finds it. It is fairly common at Asheville and seems to belong here.

Notes by Coker follow:

Small plants growing scattered in grass in lawns under oaks. Cap 3-4.5 cm. (rarely 5 cm.) broad, irregular, depressed in center, decidedly or slightly striate on the margin when mature, glabrous, viscid when damp, cuticle removable to near the center; color a dull brownish or vinaceous purple-red, the center darker, some pale, others fairly dark. Flesh thin, only about 2 mm. thick in center, white, soft, fragile but not very brittle, mild and odorless.

Gills not crowded, up to 7 mm. wide near the rounded marginal end, pointed and some of them sinuate at the stem, a few branched near the stem, no short ones, strongly connected by veins; color light, then at full maturity buff yellow (Ridgway) in edge view, and maize yellow on side view.

Stem 2-3 cm. long, 5-8 mm. thick in center, tapering downwards, glabrous, pure white and not turning yellow when wounded, minutely rugulose, softly stuffed, then hollow.

Spores buff-yellow in thick print, subspherical, distinctly blunt-echinulate (oil emersion), 6.6-9.2 μ .

These plants agree well with *R. pusilla* Pk., except that they do not grow under pines.

1090. In grass, old Holmes Place, July 6, 1914. Photo.
 2112. Under oaks in Mr. J. M. Williams' lawn, June 15, 1916. Photo.
 2114. Grass under oaks by Infirmary, June 16, 1916.
 2134. In grass in northwest corner of Arboretum, oaks near, June 17, 1916.
 2185. Poor soil in Dr. Venable's lawn, June 21, 1916.
 2537. Under oak in Arboretum, June 21, 1917.

21. *Russula meliolens* Quél.

PLATES 85 AND 111.

Cap 5-10 cm. broad, dull red or brownish red, to pale faded red, convex, firm, viscid when moist, becoming striate on the margin, smooth; taste mild; odor in drying strong of new meal.

Gills white, then cream color, rather thick, distant, broad, rounded and nearly free behind.

Stem firm, becoming hollow, nearly equal, colored like the cap at the base.

Spores cream color, subglobose, 10-12 μ long, appearing smooth under a 1/5-inch objective, delicately warted with faint reticulating lines under higher magnification.

One of our most abundant species at Asheville, especially in open places under trees. It is easily recognized if the spores are carefully examined. The peculiar odor is very characteristic.

Notes by Coker follow:

Cap 5-6.5 cm. wide, convex then expanded, viscid, light purplish brown in center, buffy-vinaceous with yellowish stains on the margin; margin striate. Flesh white, about 5-7 mm. thick, yellow around grub channels; taste mild.

Gills equal, not crowded, veined, 8-9 mm. wide, white then faintly tinted with creamy-flesh, turning yellow-ochraceous or brownish when bruised.

Stem 4-7 cm. long, up to 8 mm. thick in center, nearly equal, white with stains of yellow-ochre, but not turning yellow at once when scraped as in *R. puellaris*.

Spores faintly creamy white, spherical, very minutely roughened (more nearly smooth than any of the other species), 7.4-9.2 μ .

Much like *R. puellaris*, but stem does not stain yellow at once, and the spores are different. Old bruises show yellowish or brownish on all parts.

2128. Mixed woods (pine, oak, etc.) at top of Lone Pine Hill, June 17, 1916.
Photo.

2272. Mixed woods, Lone Pine Hill, June 27, 1916. Cap up to 10 cm. broad, viscid; stem up to 6.5 cm. long and 1.7 cm. thick at cap; gills and stem turning quickly brownish when bruised; spores subspherical, very minutely roughened, 7.4-11 μ .

22. *Russula mariae* Pk.

PLATES 86 AND 111.

Cap 2.5-7.5 cm. broad, crimson to purple or purplish-gray, dry, pruinose, even on the margin when young, striate when old, firm; flesh white, colored under the cuticle; taste mild.

Gills adnate, rather close, white, becoming cream color, often red on the margin, which is thickly set with projecting cystidia.

Stem colored like the cap, but usually paler, stuffed.

Spores light yellow, globose, 7-8 μ broad, delicately reticulate.

In woods, not rare, Asheville.

This is certainly Peck's plant. I have seen no specimens of *R. punctata* Quel., which seems closely related. Maire lays particular stress on the structure of the margin of the gills in characterizing Quelet's species. In my specimens the margin is floccose when examined with a lens and thickly set with pointed cells, which often project 50 μ beyond the other cells. This corresponds closely with his notes. The species may very possibly not be distinct.

Notes by Coker follow:

Cap up to 10 cm. broad, depressed in center or cup-shaped by the elevation of the margin which is not striate or faintly so at maturity, and with a strong tendency to crack deeply almost to the stem into several segments in age; surface scarcely at all viscid, except when bruised, and then decidedly so, granular pruinose or somewhat crustose-scurfy as in *R. crustosa*; enticle separable almost to center. We have two distinct color forms that do not intermix in any one place, though somewhat intermediate colors are occasionally found; in one the color is deep vinaceous purple, sometimes with tints and areas of old-gold or olive-gold, faded in places, often becoming blackish purple in age; in the other the color is dull red, exactly coral red, or dragon's blood red of Ridgway (in the plant No. 2351 the color was light olive and pallid tan with only a slight tint of purple in a few spots). Flesh about 5 mm. thick near center, firm and not very brittle, white then brownish after considerable exposure, mild.

Gills not crowded, almost all the same length, a few or none or many forked, pointed at the stem and just reaching it, rounded at the broad outer end, where they are about 6-8 mm. wide, veined at cap, not very brittle, nearly white when young, becoming cream color, brownish when bruised, the margin varying from distinctly rosy to no sign of rose, and dotted with minute drops when fresh like the stem.

Stem about 3.5-5 cm. long and 8-20 mm. thick at cap, largest below

usually, rosy or vinaceous red from granular dots, covered also when at all fresh with minute clear droplets of viscid dew; rarely nearly white in the red form, softly stuffed or cavernous.

Spores (of No. 2187) about cream color, subspherical, distinctly set with blunt spines and ridges, 4.4-7.4 μ . Gill margin with numerous, long spine-like cystidia, projecting about 30-40 μ .

2131. Under oaks in old Mangum lawn, June 17, 1916. Photo. with 2132. Spores spherical to subspherical, covered with blunt spines of unequal length, nearly maize yellow, 5.5-7.4 μ .

2132. Under oaks in Battle's Grove, near east gate of campus, June 17, 1916. Purple form. Photo.

2186. Dr. Venable's lawn, June 21, 1916. Red form. Spores with ridges and spines, some much more ridged than others, 6-7.5 μ .

2187. Under oaks in Professor Howells' lawn, June 24, 1916. Purple form.

2336. Dr. Wagstaff's lawn, July 1, 1916. These are the red form. They have been appearing here and along the sidewalk near for a month, and are very unlike the deep vinaceous plants of No. 2132, No. 2247, etc. All other characters are the same, except that the stem while covered with the same granules (color of cap) is less sticky than the deep colored forms, though slightly so. Gill margins usually red dotted, etc. Spores subspherical, with ridges and tubercles, 6.5-7.7 μ . Cystidia numerous and like those of No. 2186.

2351. In upper road to Scott's Hole, gravelly soil, top of hill beyond Rocky Ridge Farm, July 3, 1916.

2580. Mixed woods by Battle's Branch, July 2, 1917. Cap blackish vinaceous in center, fading to olive gray on margin.

23. *Russula cyanoxantha* Fr.

PLATE 87.

Cap 7.5-12.5 cm. broad, convex, then plane or depressed, viscid when moist, purple-gray shading into green, margin at first even, at length slightly striate; flesh firm, white; taste mild.

Gills white, becoming pale cream color, close, somewhat forked, a few shorter.

Stem firm, white, stuffed, equal.

Spores creamy white, subglobose, 8-9 μ long, marked with raised lines which form slight reticulations.

In woods, rare in Asheville.

This species has been detected only a few times. In appearance it is much like *R. variata*, but is clearly distinct from it. The spores

are never chalk-white as in the latter species, but always creamy white, and the taste in my specimens is mild. It may be said that the status of this species is not altogether satisfactory. Romell makes the creamy white color of the spores the decisive character in separating this species. Maire refers here a species with pure white spores, and specimens from him are different from ours. Our plants are, however, the same as those so referred in N. Am. Flora, and by Peck.

Notes by Coker follow:

Cap up to 10 cm. broad, convex, then depressed in center, striate on margin. Surface smooth, viscid when wet, dull and with very peculiar shades of color, purplish red in center, fading to olive or bluish-olive or a mixture of these with purple, or light purplish all over with pallid spots. Young plants are sometimes a deep dull-olive all over with a tint of purple, the margin usually with more purple. Flesh white or grayish, very thin near margin; taste mild or slightly peppery.

Gills white, often forked, moderately close, adnexed, connected at cap by veins, turning brown where bruised.

Stem short, about 3-4 cm. long, usually about 1 cm. thick, dull, pure white, stuffed and very fragile.

Spores oval, minutely tuberculate, cream, 4.8-6.7 x 7-8.2 μ .

704. In woods near Battle's Branch, June 20, 1913.

864. Woods southeast of schoolhouse, October 2, 1913.

1552. Woods near branch above Meeting of the Waters, June 18, 1915. Spores nearly white, spherical to elliptic, 5.4-7.2 x 7.2-9 μ . Plants dull olive with purple tint on margin.

1569. Battle's Park, June 21, 1915. Spores mostly spherical, some slightly elongated, minutely tuberculate, 5.8-7.5 x 7.2-9 μ .

2516. Cultivated border in the Arboretum, June 14, 1917. Cap dull vinaceous purple with olive tint on margin, taste mild or faintly peppery. Spores cream color, subspherical to short oval, warty (not reticulated), 5.5-6.5 x 5.9-7.4 μ .

24. *Russula virescens* Fr.

Cap 5-10 cm. broad, round, convex then expanded and depressed, dull green or greenish-gray, cuticle breaking into flocculent warts, even on the margin except in old plants, dry; taste mild.

Gills white, then cream color, moderately close, narrowed toward the stem, a few forked and unequal.

Stem white, becoming spongy within, equal.

Spores white, with a faint cream color, globose, echinulate, 6-7.5 μ .

In woods and open groves, not rare, Asheville.

This species is deservedly considered an excellent edible species. It is also not difficult to determine, being one of the first of the *Russulas* to be recognized with certainty. I do not find the spores chalky white, but rather creamy white. In age the green color may nearly disappear.

Colored illustrations, Gibson: Our Edible Toadstools and Mushrooms, Plate 11. Taylor; Report of Chief of Div. of Microscopy, U. S. Dept. of Agri., Plate 1, 1893.

Blowing Rock. Atkinson.

Middle district (Schw.), in woods. Curtis.

25. *Russula crustosa* Pk.

PLATES 88 AND 111.

Cap firm, 5-10 cm. broad, dingy gray, greenish gray, sometimes with dingy purple or yellowish shades, cuticle breaking as the cap expands and forming closely appressed scales, convex but depressed at the center, striate on the margin, taste mild or slightly acid.

Gills white, close, narrow, somewhat forking and unequal.

Stem white, stuffed then hollow.

Spores pale cream, echinulate, 6-7 x 8-9 μ .

Very common in woods at Asheville. The cap seems to be covered with a "crustose" cuticle which breaks up as the cap expands into scales. It is unlike all other species, being closest to *R. virescens*, which will be easily distinguished from it.

Notes by Coker follow:

Cap up to 11.5 cm. broad, usually 7-9 cm., viscid when moist, the surface with slightly elevated lines and rickulations and inherent scaly patches, very much as in *R. virescens*; depressed in center, the slightly striate margin curved downward in youth, upward in age, and more or less wavy; color very variable, usually light lilac with deep olive

and tan shades in center, or at times a brownish olive buff with scarcely a tint of lilac. In collection No. 1142 the color changed little from youth to maturity. Flesh pure white, not becoming red when cut, about 8 mm. thick halfway to margin, almost tasteless, not tardily acrid in our plants.

Gills white, becoming pallid tan and in old age blackish-brown on margins, squarely joining the stem or slightly notched, broadest near margin, where they are 5-6 mm. deep, not close, many short and a few forked ones, thick at cap, distinctly veined, the edges very smooth and even.

Stem short and thick, about 4.5-5.5 cm. long and 1.5-2 cm. thick: pure white or with a faint tint of lilac, creamy or brownish at base. Surface smooth except for slightly elevated ridges and lines; flesh white and solid.

Spores (of No. 1142) spherical to oval, minutely echinulate 6.4-7.2 x 6.4-9.2 μ .

1142. In open oak grove east of campus, July 16, 1914. Photo.

1568. By path below Lover's Leap, Battle's Park, June 21, 1915. Photo.
Spores cream color, spherical or subspherical, minutely echinulate, 5.4-7.2 x 5.4-9 μ .

1658. Near Howell's Branch, July 27, 1915.

2061. Shaded lawn in old Mangum Place, June 11, 1916. Photo.

2078. Grove at "The Rocks," June 12, 1916.

Blowing Rock. Atkinson.

26. *Russula albidula* Pk.

PLATES 89 AND 111.

Cap 5-12.5 cm. broad, firm, at first round convex, soon depressed at the center, pure white, viscid when moist, margin even or faintly striate with age; flesh white; taste intensely acrid.

Gills white, becoming cream color, 7-8 mm. broad at the center, narrowed toward the ends, somewhat forked and unequal.

Stem pure white, firm, solid, equal.

Spores about maize yellow, broadly ellipsoid, 6-8 μ long, marked with spines and raised lines, which often form broken reticulations.

This species is abundant at Asheville in pine woods, and is particularly abundant in the late fall. It is one of our most acrid species and will easily be recognized by its white color and sharp taste.

Notes by Coker follow:

Cap 7 cm. broad, expanded, depressed in center, the very margin faintly striate or even, surface smooth, pure white with buff or brownish stains, slightly viscid when moist. Flesh soft, rather thick, white, intensely or mildly acrid.

Gills crowded, none branched, slightly decurrent, 5-6 mm. wide, rounded at margin, the edges finely serrate, veined at the cap, color white then creamy.

Stem 2.5 cm. long, 1.5 cm. broad at tip, tapering downward, pure white, solid but the center soft.

Spores (of No. 1780), light ochraceous, subspherical to short elliptic, closely short-tuberculate, 5.5-6.5 x 6.3-8.5 μ .

In Chapel Hill this species varies much in its acidity and is found under cedars as well as pines: common. I doubt if this is different from *C. albidu*.

This seems to be the plant described by Curtis in the Curtis-Berkeley Mss. as follows:

"2812. (*Ag. albus* Fr.). Cap convex, very smooth and soft, whitish, alutaceous, 2-2½ in. broad. Flesh white, compact, brittle, thick. Lamellæ numerous, not crowded, in 4-5 ranks, thin, sometimes forked at base, adnate with a decurrent tooth, white, arcuate towards the margin of the cap, ventricose toward the stipe, margin irregularly erose denticulate, extending to the edge of the cap, narrow. Stipe white, subequal, 2-2½ in. long, 3-4 lines thick (becoming hollow?), farinose above, myceloid pilose below. Spores white. Taste and odor fungose. Among leaves in pine woods, attached to wood and chips. October."

1533. Pine woods at top of Lone Pine Hill, October, 1914. Spores spherical to short elliptic, 5.1-6.8 x 5.9-8.5 μ . Under an emersion lens the spores are seen to be minutely tuberculated. I cannot see that they are also reticulated, as Beardslee thinks.

1780. In same grove as No. 1533, September 14, 1915.

1909. In pine woods by road south of athletic field, October 18, 1915.

1956. Under *Pinus inops*, near King's Mill, October 31, 1915.

2567. Under cedars, Mrs. Kluttz's yard, July 2, 1917.

27. *Russula sanguinea* Fr.

PLATES 90 AND 111.

Cap 5-10 cm. broad, convex, then expanded and depressed at the center, deep red to pale red, viscid when moist, at length striate on the margin; taste very acrid.

Gills white, then pale yellow, forked and unequal, adnate or decurrent.

Stem usually red, but paler than the cap, equal, glabrous, becoming spongy within.

Spores pale yellow, broadly oval or almost globose, 8-9 μ long, strongly spinulose.

Abundant at Asheville, especially in our pine woods.

Our specimens are exactly like those which are found in Sweden. The species seems to have been misunderstood in the United States. Its intensely acrid taste and pale-yellow spores distinguish it from our other species. It is closely related to *R. rosacea* Fr., which differs in never having the gills decurrent. Some of our specimens could well be referred to the latter species.

Notes by Coker follow:

Gregarious and sometimes caespitose in groves and woods. Cap 3-7 cm. broad, plane or slightly convex, dull but not pruinose, only slightly viscid, cuticle only removable for a little way; margin slightly striate; color deep dull red, darkest in center. Flesh up to 4 mm. thick at cap, soft, white, quite acrid.

Gills rather distant, a few short and some forked near stem, up to 5 mm. wide near the rounded outer end, veined, adnexed and usually slightly sinuate or rounded at stem, none decurrent in our plants.

Stem 2-3 cm. long, 5-13 mm. thick, smooth, dull, usually tinted like the cap, but lighter, stuffed and usually hollowed.

Spores cream color, about maize yellow, moderately echinulate, elliptic, 4.8-7.4 x 5.5-8 μ .

2246. Under oaks by Gimghoul Lodge, June 24, 1916.

2308. Mixed woods at top of Lone Pine Hill, June 29, 1916.

28. *Russula lepida* Fr.

PLATES 91, 92, AND 111.

Cap 5-15 cm. broad, very firm, convex, then plane and depressed at the center, dry, unpolished, usually becoming rimose squamous, color varying from bright red to pale rosy red and pallid or even white. Flesh white, firm, somewhat acrid.

Gills thin, rather narrow, white, narrowed toward the stem, somewhat forked and unequal, frequently red on the margin.

Stem firm, solid, colored like the cap, but lighter, sometimes white.

Spores creamy white, nearly globose, 7-8 μ , not strongly spinulose, but marked with warts and a few raised lines.

This is one of our commonest and most variable Russulas. The very firm substance helps to distinguish it. Its taste is also characteristic. It is not acrid in the ordinary sense, but has rather a peculiar aromatic sharpness which Romell compares to the taste of pine needles. Very many specimens have been examined this summer for the color of the spore mass. I find it in every case pale cream, which in thin deposits might well be called white. It has, however, a distinct cream color, though it is decidedly lighter than maize yellow.

Reported as occurring in pine woods in the low districts by Curtis. Probably general through the state.

Notes by Coker follow:

Cap 4.5-12 cm. wide, expanded and irregular, the margin rounded, plane or slightly elevated in places, the center plane or slightly depressed; surface distinctly pruinose and often separating into distinct granules or scurfy areas, and characteristically much cracked and broken at full maturity; color rosy pink or rosy red (Corinthian pink to Pompean red—Ridgway) or grayish-blue-pink with yellowish or golden areas in center and sometimes very pale places; some young plants are deep dull red all over or red-gold in center and gold on margin, and old plants become pinkish-pallid with a buffy center and very spotted. Flesh white, dry, quite firm and solid, not fragile, about 5-6 mm. thick near center, distinctly but mildly acrid or bitterish-acrid.

Gills moderately close, a few or a good many or none forked and some short, nearly white then cream color, sometimes *turning distinctly a clear lemon yellow when bruised*, and after a while reddish ochraceous, sometimes turning slowly to sordid yellowish without the quick change to bright yellow, up to 1 cm. wide, the outer end rounded, narrow at stem, distinctly attached, veined.

Stem pure white all over usually or lightly tinted with rose, turning

yellow or sordid and then brown when rubbed, 3-6 cm. long and 1.3-3 cm. thick at top, usually largest below, solid, stuffed, surface dull, rugulose.

Spores creamy-white, subspherical, very minutely roughened, 5.0-5.5 μ .

Colored illustrations: Gibson, Our Edible Toadstools and Mushrooms, Plate 12. Palmer, Mushrooms of America, Plate 6.

2173. Under oaks in Battle's Grove, June 20, 1916.

2213. Under oaks, lawn of "The Rocks," June 24, 1916.

2249. Under oaks, Professor Howell's yard, June 24, 1916. Spores cream color, subspherical, moderately tuberculate, 7.4-10.3 μ .

2256. Battle's Grove (oaks), June 26, 1916.

2258. Battle's Grove (oaks), June 26, 1916. Photo.

29. *Russula foetans* Fr.

PLATES 93 AND 111.

Cap 5-12.5 cm. broad, dingy yellow to brownish yellow, becoming expanded and depressed at the center, viscid, the margin deeply tubercular-striate; taste acrid.

Gills whitish, crowded, adnexed, many shorter and forked, often exuding watery drops, especially in young plants. Odor strong and unpleasant, especially in hot weather.

Stem soon hollow, white, cylindrical, becoming dingy when handled.

Spores creamy white, subglobose, 7-9 μ long, marked with strong reticulating lines.

Common at Asheville, and easily recognized.

Notes by Coker follow:

A large plant that is common in woods, lawns and borders, and is even found in manured soil, a habitat not affected by other russulas. Taste disagreeable at first, then peppery, or hardly so; odor distinct even when young, and rather disagreeable; somewhat like rubber, at maturity.

Gills sordid cream when young, and scarcely darker at maturity, except that, when bruised, they turn a sordid brown.

Under a lens the surface of both stem and cap is minutely roughened. The strong and rather disagreeable taste and odor makes this

plant useless as a food, and it has been considered poisonous, but Captain McIlvain says that "On two occasions I ate enough to convince me that it was not poisonous."

Spores (of No. 1108) spherical to slightly oval, coarsely reticulated, 6.5-7.4 μ in diameter.

Colored illustration: *Mycologia* 4:292, Pl. 74. 1912.

123. Battle's Park, near house, September 14, 1910.
 574. Under pines on side of hill near Howell's Branch, October 17, 1912.
 702. Woods along Battle's Branch, June 20, 1913.
 865. Woods south and east of Graded School, October 2, 1913. Photo. Spores light cream, spherical, spinulose, one large oil drop, 6.5-9.2 μ in diameter.
 1091. Campus, north side, July 6, 1914.
 1108. By path along west branch of Meeting of the Waters branches, July 9, 1914.
 1604. In low damp place by Battle's Branch, July 12, 1915. Spores spherical, tuberculate, 8-10 μ in diameter.
 2116. In grass on campus, June 16, 1916.

Blowing Rock. Atkinson.

Middle district (Schw.), woods. Curtis.

30. *Russula pectinata* Fr.

PLATES 94 AND 111.

Cap 4-8 cm. broad, deep gray-brown (dark bistre, Ridgway), when fresh and young, becoming paler with age, and brownish gray, usually darker at the center, viscid when wet, flesh thin, margin deeply striate halfway to the center: taste slowly acrid.

Gills white, nearly equal, a few forking near the stem, rather close.

Stem white, equal, glabrous, stuffed then hollow within.

Spores cream color, ellipsoid, spinulose 7-8 x 5-6 μ .

I find this in lawns under oaks. The cap is almost black at first in some specimens. The odor is much less unpleasant than that of *R. foetans*. The spores are also distinctly different from those of *R. foetans* when they are highly magnified. My specimens closely resemble Boudier's figure of *R. sororia* Fr.

31. *Russula pulverulenta* Pk.

PLATES 95 AND 111.

Cap rather thin 4-8 cm. broad, pale cream, sprinkled with ochraceous granules, which are close together at the center and scattered toward the margin, striate and tuberculate on the outer third; taste mild; odor in fresh plant not noticeable.

Gills white, nearly equal, a few forking near the stem, rather thin, not crowded, adnate.

Stem stuffed, contracted above, thickly set with yellow granules, which are less dense at the apex.

Spores elliptic 7-8 x 6-7 μ , marked with spines and ridges.

Only one specimen of this interesting species was found. It is a very distinct species and agrees well with the descriptions, except that I do not find the spores globose.

32. *Russula luteobasis* Pk.

PLATE 96.

This has been found in North Carolina at Chapel Hill only, and the following description is by Coker:

Cap 4.5-10 cm. broad, plane and usually depressed in center at maturity, smooth, glabrous, dull, striate at maturity only on the extreme margin, only slightly viscid; color a pretty light rose on margin, shading rather abruptly to buffy-yellow in center with the latter tint in places elsewhere. Flesh about 4-5 mm. thick at stem, pure white, firm, not very brittle, quite mild.

Gills moderately close to subdistant, some short and a very few branched near stem, depressed at stem and just reaching it, about 5-6 mm. broad near the rounded outer end, veined, nearly white, then light cream color at maturity, not changing color when wounded.

Stem 3.5-5 cm. long, 8-12 mm. thick at cap, somewhat larger below, pinched at base, smooth, white above and strongly orange yellow at very base and light creamy-buff between, stuffed, then cavernous.

Spores creamy-yellow, moderately tuberculate, elliptic, 5.5-6.6 x 6.6-8.5 μ .

2252. Battle's Grove (oaks), June 25, 1916. Photo.

2563. Battle's Grove, June 25, 1917.

33. *Russula rubescens* Beardslee.*

PLATES 97 AND 111.

Cap convex, then expanded and depressed, 5-9 cm. broad, red, paler on the margin, fading with age, thin, striate on the margin.

Gills rather close, white, adnate, forked, especially at the base.

Stem white, stuffed, nearly equal, becoming red then black when wounded, at length cinereous within.

Spores pale yellow, subglobose, 7-9 μ long, spinulose. Cystidia numerous.

In woods, not common. Asheville.

This seems to be a well marked species. The quick change of the stem when wounded to red then black at once separates it from all other red species except *R. cinerascens*, which is amply distinct. It has been detected in Michigan and will doubtless be found generally in our State.

34. *Russula magna* n. sp.

PLATES 98, 99, AND 111.

Cap 8-15 cm. broad, round convex, then expanded, cream color to buff, darker at the center, smooth and shining, with a texture like kid as it dries, flesh white, becoming cinereous with age, very firm and solid.

Gills 5-10 mm. wide, thick rather distant, a few forking and shorter, cream color, distant from the stem, rounded behind.

Stem 5-8 cm. long, 2-3 cm. thick, white, enlarged above, often obscurely ridged, changing to red then black when wounded, becoming entirely cinereous within with age.

Spores 7-9 μ , globose, nearly smooth, with delicate reticulating lines; pale buff-yellow.

In drying the cap and stem blacken more or less. The buff color of the cap often is left in patches, and the gills tend to blacken less than the other parts. In the main, however, it blackens much like *R. nigricans*. The fresh plant has a rather pungent smell, which becomes much stronger in drying and is then quite offensive. It is a

*See Mycologia 6:91. 1914.

strong "piggy" smell. Coker speaks of it as like the smell of a sweaty horse. At all events it is very powerful and very bad. The dried specimens would probably be taken for *R. nigricans*, but it is amply distinct from that species. The yellow spores, nearly equal gills, strong odor, at once distinguish it.

Asheville, as Nos. 15065, 12002, and 16083.

Notes by Coker follow:

A large and very peculiar plant. Cap 15 cm. broad, margin strongly upturned, surface smooth, shining, deep gray-brown in center, shading to nearly black on marginal third, cracked into lines and areas, especially in center. Flesh firmly spongy, a gray color, taste mild.

Gill surface light buff (Ridgway), almost cinnamon buff in deep view, not close, broadest in marginal half and abruptly rounded at ends, distant from stem and terminating abruptly, not decurrent, connected at cap by very high and conspicuous veins, 1.3 cm. deep near margin, $1\frac{1}{4}$ mm. thick, rather brittle, their flesh drab color like that of the cap. In drying, the gills turn almost black.

Stem 6 cm. long, 3 cm. broad in middle, tapering rapidly downward, enlarged at top, obscurely ridged, smooth, nearly white at top, then shading through light gray to a deep blackish-brown at base; flesh exactly color and texture of that of cap, solid.

Spores cinnamon buff, spherical, slightly rough, a large oil drop, $7.4-11\mu$ in diameter.

This is somewhat like *R. nigricans*, but differs sharply in the strong odor and colored spores. It is most nearly related to *R. xerampelina* Fr. (*R. squalida* Pk.), but the size is considerably larger and the odor is different. One of the most remarkable qualities of this plant is the peculiar penetrating and persistent odor. The smell is a good deal like that of a sweating horse, only more aromatic. The odor was strong for days after the plant was brought in; and, if touched, the odor clung to the fingers for hours.

35. *Russula xerampelina* Fr.*R. atropurpurea* Pk.

PLATES 100 AND 111.

Cap 3-10 cm. broad, convex, soon depressed, appearing slightly pruinose under a lens, smooth, but unpolished and opaque to the naked eye, very variable in color, dull red, purple or grayish purple, olivaceous, yellow or pale orange, or nearly white, margin even or slightly striate with age: taste mild, odor in drying very strong and fetid.

Gills white, then yellowish, rather broad, rounded behind, somewhat unequal, becoming yellow then brown when wounded, dingy brown in drying.

Stem white, equal, spongy within, becoming yellow when wounded.

Spores deep yellow, 8-10 x 7-8 μ , echinulate.

This is at the same time one of our most abundant and variable species. The great range of colors is apt to give the beginner trouble. The stem, however, in all its forms quickly becomes yellow when scraped, and its strong odor in drying is very characteristic. The dingy color of the gills in the dried plants helps in identifying it. This species is abundant in Sweden and was described by Romell as *R. graveolens*. It is now considered by Romell and Maire to be *R. xerampelina* Fr., and it seems best to follow them. It is also *R. atropurpurea* and *R. squalida* Pk.

A curious form of this species, which seems not to be common, is found in our pine woods. It varies from orange to yellow, and is so distinct in appearance that it is hard to believe that it is the same as our red and purple forms. It has, however, the same microscopic structure and the same discoloration when wounded and the same strong odor when drying (see *Mycologia* 6:90. 1914).

Notes by Coker follow:

Cap surface minutely tomentose-velvety, margin slightly striate in age, color of No. 1779, a peculiar deep vinaceous-purple in center, fading to much lighter dull ashy-purple on margin; color of 2115, dull vinaceous-purple with faded yellowish areas, the margin pale. Flesh light ashy-brown or sordid white, changing to a somewhat deeper

brown when cut, soft, not very brittle, about 5 mm. thick at stem, a mere membrane at margin, taste mild, odor strong and disagreeable on drying, and remaining noticeable on the hands for a long time after touching.

Gills moderately close or rather distant, a few or none forked, veined at cap, 4-8 mm. wide, pointed at stem, rounded at margin, whitish, then turning ashy-brown, then deeper in drying, brownish when bruised.

Stem 3-4 cm. long, nearly equal or tapering either way, white, turning quickly brown when bruised, somewhat pruinose, faintly rigid longitudinally, solid, flesh like that of cap.

Spores yellow (about pale orange yellow of Ridgway), subglobose, echinulate, 6.3-9 μ .

Easily distinguished by the stem changing quickly to brownish when rubbed, and by the strong odor when beginning to dry.

1779. Low, damp, shaded ground at foot of Lone Pine Hill, September 14, 1915.
2115. Grass under oaks by Infirmary, June 16, 1916. Photo.

36. *Russula puellaris* Fr.

Cap 2.5-5 cm. broad, thin, slightly fleshy, convex then expanded, viscid when moist, pale purple or dingy purple, margin thin, striate; taste mild or very slightly aeric.

Gills thin, rather crowded, white, then yellow, at length pulverulent, attenuate towards the stem.

Stem stuffed, then hollow, fragile slender, becoming yellow when wounded.

Spores pale yellow, subglobose, spinulose, 6-8 μ long.

In woods, rather rare. Asheville.

Specimens found at Asheville seem the same as those found in Sweden. It has been found only sparingly.

Notes by Coker follow:

2558. In moss, cool damp woods at foot of Lone Pine Hill, June 23, 1917.
Easily recognized by small size, vinaceous color, and change to yellow. It is very like *R. pusilla* except for the yellow stains.

37. *Russula aurata* Fr.

PLATES 101 AND 111.

Cap 5-10 cm. broad, firm, viscid when moist, beautiful golden yellow, darker and shaded with orange at the center, cuticle separable on the margin, flesh beneath bright lemon yellow, even on the margin, becoming striate with age; taste mild.

Gills pale whitish, becoming light yellow, rounded, free, not crowded.

Stem firm, spongy within, pure white.

Spores deep yellow, ellipsoid, marked with reticulating lines, 7-9 μ long.

In lawns under oaks. Asheville.

This is one of our most beautiful species. It seems to be rare in the United States, and some doubt has been expressed as to its occurrence. My specimens have exactly the spores of specimens received from Maire. The Swedish *R. aurata* is mild in taste, as is the plant I have so referred. I have found no specimens with the margin of the gills more deeply colored; but according to Maire, that is not always true of the European plant.

Notes by Coker follow:

Cap up to 8 cm. broad, lightly convex, depressed in center, margin regular, becoming slightly striate; surface glabrous, viscid, with a separable cuticle, a fine golden or orange yellow. Flesh about 4 mm. thick near stem, yellow, mild.

Gills not crowded, almost all the same length, sinuate-attached, about 8-9 mm. wide, thick, whitish then light yellow, their flesh yellow.

Stem up to 8 cm. long, about 1.8 cm. thick at top, somewhat irregular, constricted at base, surface glabrous, rugose, white, or with faint yellow stains; flesh white, soft inside, not hollow.

Spores distinctly yellow, spherical, spinulose, 7.4-9.2 μ .

2083. Swamp of New Hope Creek, near Durham bridge, June 13, 1916.

2225. Bank of New Hope Creek, one-fourth mile below Durham-Chapel Hill bridge, June 24, 1916.

38. *Russula basifurcata* Pk.

PLATE 102.

Cap up to 9 cm. broad, soon depressed at the center, viscid when moist, white with tints of yellow and rose, especially toward the margin, glabrous, margin at length slightly striate, cuticle separable on the outer third. Flesh thin at the margin, white; taste mild, then slightly bitter and very slightly acrid.

Gills rather close, white, then cream color, forking, especially near the stem, about 5-7 mm. broad at the center, narrower and slightly emerginate toward the stem.

Stem white, stuffed, about 4 cm. long, 1.5 cm. thick.

Spores pale yellow, a little darker than Ridgway's maize yellow, round ellipsoid to subglobose 6-7 μ . The spores of this species are a shade lighter than those of *R. olivascens*. The colors of the two species are quite different. I find this rather rare.

39. *Russula grisea* Pers.

R. glauca Burl.

PLATE 103.

Cap 6-10 cm. broad, soon becoming depressed at the center, dingy-white or creamy-white, tinged with yellow at the center, sometimes reddish to buff-red, viscid when moist, cuticle separable halfway to center, even on the margin; taste mild.

Gills white, then cream color, adnate, many forking at or near the stem, almost none short.

Stem white, firm, equal, short, 2 cm. long, 1-1.5 cm. thick.

Spores pale yellow, broadly elliptic, 7-8 μ long, marked with spines and a few raised lines which form broken reticulations.

This species is found in abundance at Asheville in lawns under oaks. It seems to shade into the following species. I find it occasionally in groups in which some plants have a distinct olive green tint, while others are typical and white or creamy-white.

Notes by Coker follow:

Cap up to 9 cm. broad, depressed in center, margin slightly striate, color dull straw in center, the margin pallid straw and striate for a little way at maturity; cuticle viscid, removable.

Gills hardly crowded, some forked at base, none short, veined at cap, creamy-yellow (maize-yellow) at maturity, decidedly lighter than the spores.

Stem about 5 cm. long, 18 mm. thick, rugulose, white, becoming cinereous below, spongy within, exactly light cream yellow of Ridgway.

Spores subspherical to short elliptic, short spinulose, a clear creamy yellow, $4.8-5.5 \times 5.5-7.4\mu$, exactly like the spores of Beardslee's plant.

2564. Oak grove in front of Dr. Battle's, June 25, 1917. Photo.

40. *Russula olivascens* Fr.

PLATE 111.

Cap 4-10 cm. broad, convex, then depressed at the center, olivaceous, with the color deepest at the center, and pale toward the margin, viscid when moist, margin even; taste mild.

Gills white, becoming cream color then yellow, rounded behind, somewhat forked, a few shorter.

Stem white, firm, glabrous.

Spores broadly elliptic, pale yellow, $7-9\mu$ long, marked with spines and raised lines which form broken reticulations.

In woods, not rare. Asheville.

The spores of this and the preceding species are a deep creamy yellow, about pale orange-yellow of Ridgway.

Notes by Coker follow:

Cap up to 9.5 cm. broad, depressed in center at maturity, margin rather faintly or clearly striate, surface glabrous, viscid and much stuck with dirt, dull olivaceous or pale brownish olivaceous and sometimes with faint purplish tints, margin even or slightly striate, cuticle removable about one-third way to center. Flesh pure white, firm, rather brittle, mild, not turning brown when bruised, about 8-9 mm. thick at stem.

Gills moderately close, about 5-6 mm. wide near the center, pointed at each end, nearly all of the same length, a few forked near the stem, lightly veined at cap, whitish, then pallid fleshy-cream, slowly changing to light smoky brown when rubbed.

Stem about 4.5-5.5 cm. long and 1.9-2.3 cm. thick, pure white, glabrous, stuffed.

Spores creamy yellow, subspherical, minutely tuberculate-roughened, 6.6-9.2 μ .

2129. Mixed woods near the barn, Glenn Burnie Farm, June 17, 1916.

41. **Russula graminicolor** Quél.

Cap 5-10 cm. broad, convex then plane, or depressed, quite viscid when wet, green, shaded with brown, especially at the center, margin thin, becoming striate; taste mild.

Gills pale cream color, darker with age, adnate, forking near the stem.

Stem white, firm, equal, glabrous.

Spores pale yellow, broadly ellipsoid, 7-9 μ long, spinulose.

My plants closely resemble Riekens' figure. The spores are different from those of *R. olivascens*. It is rare at Asheville apparently, having been found only once.

42. **Russula subvelutina** Pk.

PLATE 104.

Cap 5-10 cm. broad, convex then depressed, varying in color from a pink-red (Eugenia red—Ridgway) to pink or almost flesh color, dry, minutely pubescent, margin even, sometimes slightly striate with age; taste mild.

Gills white then cream color, often forked, adnate.

Stem usually colored like the cap, but paler, spongy within, becoming hollow.

Spores pale yellow (warm-buff—Ridgway), 7-9 μ , subglobose, marked with warts and raised lines which are slightly connected in broken reticulations.

In pine woods, not rare. Asheville.

The cap of this species suggests *R. uncialis*, but the spores are distinctly different. The color of my plants is paler than the description would indicate, but it seems best to describe the form which occurs in our territory. It is a very pretty species.

Notes by Coker follow:

Cap about 2-3.8 cm. wide, regular or irregular, convex, or at maturity slightly depressed in center; surface minutely granular-tomentose, looking something like the surface of *Fistulina hepatica*, margin slightly striate; color an odd pinkish-red (exactly geranium pink or light coral-red of Ridgway), with yellowish spots, cuticle removable, noticeably sticky when bruised. Flesh thin, white, taste mild. There is a faint but distinct odor of peculiar character, resembling the smell in a laundry, it seems to me.

Gills all the same length, none or a few forked, rather close, light creamy yellow, connected by veins at the cap, their margins sometimes sticking together so tightly as not to be separated without breaking, adnate to stem, about 3-4 mm. deep.

Stem pure white or tinted with pink, 2.2-3 cm. long, 7-10 mm. thick at top, tapering downward, surface faintly scurfy-granular or appearing smooth, inside soft, cavernous.

Spores light creamy yellow, subspherical, rough, 5.4-7.5 μ in diameter, no cystidia on gills.

This species is small in Chapel Hill. The color is decidedly a pink rather than red and is easily recognized. Miss Burlingham gives as a distinction between this and *R. Mariae* that the context is not sticky when bruised; but in our plants the rubbed surface becomes decidedly sticky just as in *R. Mariae*.

1648. One plant, in mixed woods southeast of Dr. Battle's, July 26, 1915.

1732. In sandy soil, woods near Battle's Branch, September 10, 1915.

2267. Mixed oak and pine woods, Lone Pine Hill, June 27, 1916. Spores elliptic, moderately roughened with low lines and warts, 4.8-7.4 x 7.4-10 μ .

2304. Pine and oak woods, top of Lone Pine Hill. June 29, 1916.

2526. Mixed pine and oak woods southwest of athletic field, June 18, 1917.

Blowing Rock. Atkinson.

43. *Russula nauseosa* (Pers.) Fr.

PLATE 105.

This has been found only at Chapel Hill, and the following description is by Coker:

Cap about 5-7.5 cm. broad, depressed in center at maturity, irregular, margin striate for 0.5-1 cm. ; surface quite viscid when wet, a dull deep purplish red in center, fading to dull brownish or buffy with a slight vinaceous tint. Flesh about 5 mm. thick at stem, pallid white, mild but faintly disagreeable, not very brittle.

Gills 5-8 mm. wide, crowded at stem subdistant at margin, all of equal length and none forked, just reaching stem, pallid when young, dull cream color at full maturity.

Stem 3-4.5 cm. long, 12-18 mm. thick, nearly equal, glabrous, white all over, stuffed, not hollowed.

Spores pale orange yellow of Ridgway, subspherical, echinulate, 5.9-8 μ .

2122. Oak grove south of President's house, June 16, 1916. Photo.

We have also found in Chapel Hill a plant that varies somewhat from the above and seems to agree with *R. Turci* Bres., which Maire thinks is the same as *R. nauseosa*. I describe it as follows:

Cap viscid, shining depressed, margin tuberculate-striate. Odor distinct, sweetish, not unpleasant, not at all like that of *R. xerampelina*; color an odd purplish-brown which was much deeper in a zone halfway to margin.

Gills pale tan on side view, between buff-yellow and maize yellow (Ridgway) on edge view, smoky on drying.

Stem white, turning slowly smoky when rubbed, *not* yellow.

Spores buff-yellow, short-elliptic to subglobose, marked with lines which are more or less reticulating, 7-9 μ .

2441. Mixed woods near creek below Lone Pine Hill, September 18, 1916.

44. *Russula Romellii* Maire.

PLATE 106.

Cap 5-10 cm. broad, convex, becoming depressed, dry, pruinose, dark red or purple red, even on the margin; flesh white, red under the cuticle.

Gills subdistant, yellowish, becoming deep yellow.

Stem equal, colored like the cap, but lighter, firm.

Spores deep yellow (ochraceous buff—Pk.), 8-9 μ , marked with raised reticulating lines.

In woods, common. Asheville.

This species, if it is well founded, scarcely differs from *R. alutacea* except in the character of the spore surface.

45. *Russula alutacea* Fr.

PLATES 107 AND 111.

Cap fleshy, large and firm, 6-12 cm. broad, viscid when moist, red, or purple red, sometimes with olive or green tints, even at first on the margin, then striate or tuberculate-striate; taste mild.

Gills broad, thick, pale yellow at first, then ochraceous, rounded and nearly free behind.

Stem solid, white or colored like the cap.

Spores ochraceous, broadly ellipsoid, 9-11 μ long, spinulose.

This is a fine, robust species, but it is not common near Asheville. The deep yellow spores and mild taste will help in its recognition, though it appears in many disguises.

Notes by Coker follow:

Cap to 12.5 cm. in diameter, conspicuous on account of its bright deep-red color, which often fades into pallid reds in spots and in age usually assumes a purplish-red tint (almost rosolane purple Ridgway); surface smooth and viscid, with striate margin usually, but in fresh specimens the striæ are often scarcely noticeable. Flesh very soft, white or rosy. Spores between maize yellow and buff yellow (Ridgway), slightly lighter than those of *R. tenuipes*, spinulose, nearly spherical, about 6-10 μ in diameter.

Common here in woods, groves, and grassy places, and easily distinguished by the red cap, distant and very deep-colored (antimony yellow) gills, deep-colored spores, and mild taste. Edible. It seems to me quite doubtful if *R. ochrophylla* Pk. is really distinct from this.

697. University campus, June 19, 1913. Abundant at this date.

868. Woods southeast of schoolhouse, October 2, 1913. Spores spherical, echinulate, one large oil drop, 6.5-8.3 μ in diameter.

1107. Woods by branch above Meeting of the Waters, July 9, 1914. Photo.
Spores about buff yellow, spherical, short-echinulate and with a conspicuous mucro, 7.4-9.2 μ .
1364. In new road to Piney Prospect, north of cemetery, October 16, 1914.
1690. In Professor Howell's lawn under oak trees, September 6 and 7, 1915.
Spores spherical to subspherical, echinulate, 5.8-7.2 μ .
1734. In woods near Meeting of the Waters, September 10, 1915. Spores spherical, echinulate, one large oil drop, 6.5-10 μ .
2081. In grass on campus, June 13, 1916.
2090. Dr. Lawson's lawn and in Battle's Park, in grass, June 14, 1916.
2184. Mrs. Kluttz's yard, June 20, 1916. Spores subspherical, moderately spinulose, 7.4-9.2 μ .
2271. Woods at top of Lone Pine Hill, June 27, 1916.

46. **Russula aurantialutea** Kauffman.

PLATE 108.

Cap 2.5-5 cm. broad, soon depressed at the center, coppery orange with the center lighter and yellow to pale yellow, fading with age, viscid when moist, becoming striate on the margin with age, cuticle separable halfway to the center; taste slowly acrid.

Gills white, becoming pale yellow, attenuate toward the stem, a few shorter and forking.

Stem white, glabrous, soon hollow, slender.

Spores yellow (about cadmium yellow of Ridgway), 7-9 x 7-8 μ , strongly spinulose.

In oak woods, rather common. Asheville.

This is a pretty species and can be found all through the summer. As it occurs at Asheville, it is smaller than the type, which Kauffman finds up to 5 inches. Otherwise it answers well to the description.

46. **Russula tenuiceps** Kauffman.

PLATES 109 AND 111.

Cap 6-12 cm. broad, convex, soon expanded and depressed at the center, deep red, often with white or faded portions especially at the center, glabrous, viscid when moist, striate on the margin when mature, cuticle separable on the margin; taste acrid, odor in drying rather unpleasant.

Gills white, then pale yellow, becoming ochraceous in drying, equal, not forking, rounded behind.

Stem white, 6-12 cm. long, stuffed then hollow, becoming red when wounded, and slightly gray in drying.

Spores ochraceous, elliptic, 7-9 μ long, marked with raised lines and warts.

This species is common in our woods. My specimens have been compared with some from Kauffman and seem to agree. It will be noted that one of the characters of my plant, the reddening of the stem, is not noted in the original description. In my region I find the stem always changing in the manner described, and find it a convenient mark of identification. The change in color is not rapid, but it is very marked. About two minutes are required for the change. It was thought at first that our plant must be distinct from Dr. Kauffman's species, but the agreement of the specimens with those from him makes it seem better to refer our plant to his species. It is quite possible that this character will be found in the Michigan plants.

Notes by Coker follow:

Cap about 9-11.5 cm. broad, depressed at the center, deep red with faded areas often, margin striate, cuticle removable on margin, glabrous, viscid when wet, often white-dotted from the gnawing of snails; thick near center, pure white, quite fragile and brittle, acrid, odorless.

Gills scarcely crowded, nearly all the same length, few or none forked, about 1 cm. broad, veined at cap, nearly white, then rather light ochraceous.

Stem about 5-8.5 cm. long and about 2 cm. thick, nearly equal, or variously irregular, occasionally swollen to about 2.8 cm. thick, except at top; surface glabrous, rivulose, pure white all over, slightly stuffed, then cavernous.

Spores between buff-yellow and antimony yellow of Ridgway, subspherical, marked with short spines and broken ridges, 6.6-9.6 μ .

Common in summer in groves and woods.

2126. On campus near Confederate Monument, June 16, 1916. Photo.

2127. Mixed woods at top of Lone Pine Hill, June 17, 1916.

47. *Russula pungens* n. sp.

PLATES 110 AND 111.

Cap 6-12 cm. broad. peach red to opal red, with areas which are paler or even nearly white, firm, slightly viscid when young, even or slightly striate on the margin with age, minutely velvety. Flesh white, red under the cuticle, which is separable on the margin only; taste quickly and intensely acrid.

Gills white at first, cream color, in old specimens, rather crowded, 7-10 mm. broad at the center, rounded at the stem, many forking at the stem, a few forking elsewhere and shorter.

Stem firm, 7-10 cm. long, 1.5-2.5 cm. thick, white, spongy stuffed.

Spores subglobose, to broadly elliptic, 7.5-9 μ long, marked with spines and short ridges. Margins and sides of gills thickly set with prominent projecting cystidia; color in mass close to Ridgway's pale orange-yellow.

This is one of our largest and finest species. It was collected in quantity the past season and carefully studied. It is distinctly different from *R. tenuiceps*. The spores are very different in color, being distinctly lighter. Fine spore prints were found to be much darker than *R. sanguinea* and lighter than *R. alutacea* and *R. tenuiceps*. They are very close to the spore color of *R. atropurpurea* Pk. The intensely acrid taste seems its most striking character. It is easily the most acrid species found in the region around Asheville. If incautiously tasted the effect is positively painful, more so than in the case of *R. fragilis*, *R. sanguinea*, or *R. albidula*, which are probably three of our most acrid species.

In many ways this species seems to resemble *R. badia* Quél. but Miss Burlingham has compared my specimens with those of *R. badia* at New York, and finds them different. *Russula rubra* Kromb. as it is described and figured by Bresadola in *Fungi Tridentini* is also suggestive of our plant. The spore color, intensely acrid taste, and minutely velvety cap which Bresadola ascribes to it are all characteristic of our species. I have, however, seen no specimens of his plant, and should be reluctant to use his name in view of the uncertainty in regard to its correct application, even though our plants

should prove identical. Romell, who has seen our specimens, does not recognize them as occurring in Sweden. Our plant is certainly a fine and distinct species, and I have therefore somewhat reluctantly described it as new, though it may prove not to be unknown in Europe.

ASHEVILLE, N. C.